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*Patent*

UNITED STATES PATENT APPLICATION

FOR

INFORMATION DISPLAY

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## INFORMATION DISPLAY

### CROSS-REFERENCE TO RELATED APPLICATIONS; PRIORITY CLAIM

[0001] This application claims benefit of prior United Kingdom application 0317493.5, filed July 25, 2003, entitled "Information Display," the entire contents of which is hereby  
5 incorporated by reference as if fully set forth herein, under 35 U.S.C. §119.

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### FIELD OF THE INVENTION

[0003] The present invention generally relates to data processing. The invention relates more specifically to information display.

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### BACKGROUND OF THE INVENTION

[0004] The approaches described in this section could be pursued, but are not necessarily approaches that have been previously conceived or pursued. Therefore, unless otherwise indicated herein, the approaches described in this section are not prior art to the claims in this application and are not admitted to be prior art by inclusion in this section.

[0005] Modern display or presentation devices typically include computer apparatus such as networked, desktop, laptop, handheld or tablet personal computers (PCs), personal digital assistants (PDAs), interactive television terminals, gaming apparatus and cell phones. Each item of apparatus usually has a single display, and this may be in the form of a traditional  
5 computer, television or cell phone display screen or may take the form of projection equipment, virtual reality goggles, projection spectacles, holographic projections, electronic paper or cerebral implants.

[0006] There is a desire amongst viewers accessing a large volume of material content to be able to browse and navigate the full set of content in order to find a subset or single unit of  
10 content which is relevant or interesting to the viewer. Currently such browsing and navigation is typically conducted by means of descriptive text typed into search engine software and thereby matched to text contained in the material content itself or to text which a content provider has used to label the content. Browsing and navigation is also sometimes aided by third-party content categorisers who provide directories and sub-directories of  
15 content labels and descriptions.

[0007] However, these techniques for browsing and navigating large volumes of material content for display inevitably rely upon the individual viewer's skills in language and logic, as well as that of the content providers. With directory searching, the viewer must guess and replicate the logic followed by the third-party content categorizers, who must categorize and  
20 describe material content accurately and in a way which will readily be found by the intended viewers. With text entry searching, viewers need a good verbal memory to think of appropriate search terms, an extensive vocabulary, and skills in using Boolean logic in order to enter the most effective text, and content providers must accurately guess which keywords will be entered by viewers searching for their material content.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]** For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made to the accompanying drawings in which:

5 **[0009]** Figures 1, 3 and 4 are views of a screen display generated by one embodiment of a method according to the present invention.

**[0010]** Figure 2 is a flow diagram illustrating the sequence of steps of the method of Figure 1.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art that the present invention may be  
5 practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the present invention.

[0012] The invention is a method of organizing and displaying a large volume of material content in a manner that can be easily browsed and accurately navigated by a viewer without  
10 relying upon the viewer's, nor the content providers', skills in language or logic.

[0013] The material content may be information in any form, for example: data, numbers, text, still images such as photographs and graphics, moving images, virtual control panels and sound. It may be retrieved from a local computer disk or removable storage media or any form of network such as a local area network, a wireless network, a cell phone  
15 network, a wide area network, an internet, extranet or the Internet. The invention may, for example, be used for displaying material content on a computer screen and navigating through the type of material content typically found on the Internet.

[0014] According to one aspect of the present invention there is provided a method for organizing and presenting material content on a display to a viewer, the method comprising:  
20 mapping a plurality of display windows within a virtual three-dimensional space so that each display window is allocated a specific and predetermined position in the space, rendering each display window in three-dimensional perspective according to its position and angle relative to a viewer's virtual position in the virtual space, cross-referencing the position of

each display window to a storage location of the material content that is designated to be rendered in that particular display window at a particular time based on at least one predetermined condition, allocating at least part of the three-dimensional virtual space to display windows whose content is not chosen or determined by the viewer, selecting,

5 retrieving and preparing material content for possible subsequent display, according to a predetermined algorithm, selecting and rendering prepared material content within its cross-referenced display window, according to a predetermined algorithm, and providing a means of virtual navigation that changes the viewer's position in the space in such a manner as to simulate movement through a plurality of predefined channels in the virtual space.

10 **[0015]** A browser adapted to perform this method is also provided, as is apparatus programmed to operate the browser.

**[0016]** According to a second aspect of the present invention there is provided apparatus for organizing and presenting material content on a display to a viewer, the apparatus comprising: a display, means for mapping a plurality of display windows within a three-

15 dimensional virtual space so that each display window is allocated a specific and predetermined position, means for rendering each display in three-dimensional perspective according to its position and angle relative to the viewer's position in the virtual space, means for cross referencing the position of each display window to the network address or storage location of the material content that is designated to be rendered in that particular display

20 window at a particular time based on at least one predetermined condition, means for selecting, retrieving and preparing material content for possible subsequent display according to a predetermined algorithm, means for selecting and rendering prepared material content within its cross-referenced display window according to a predetermined algorithm, and means for navigation controlled by the viewer that changes the viewer's position in such a

manner as to simulate movement through a plurality of predefined channels in the virtual space.

[0017] According to a third aspect of the present invention there is provided a virtual space manager comprising a content configurator that includes the interface for the creation,  
5 maintenance and updating of the configuration which incorporates a plurality of cross references of content material to render in display windows.

[0018] According to a fourth aspect of the invention the method of the first aspect may be adapted as a business method for example when used to supply in exchange for financial payment the right to specify the network address or storage location of material content that  
10 is to be rendered in a particular display window at a specified location at a particular time, and optionally enabling and recording the transfer of rights in exchange for financial payment, and/or providing an auction system inviting financial bids to the current holder of rights and awarding the rights to the highest bidder provided predetermined conditions are met, and/or providing advertising opportunities in the three-dimensional virtual space in  
15 exchange for financial payments.

[0019] In addition, a viewer's navigation into a restricted area of the three-dimensional virtual space is allowed for a particular period of time in exchange for financial payment. Added value services may also be provided in exchange for financial payments, e.g. avatar companions, guides to navigation, the ability to navigate simultaneously and interactively  
20 with one or more other actual viewers, e-commerce support, and financial services including foreign exchange, credit and budget planning.

[0020] The method of the invention may be used to enable any one or more of Internet browsing, virtual stores, virtual supermarkets, virtual shopping malls, virtual retail catalogues, knowledge management, virtual exhibitions, medical records management,

virtual hospital patient management, virtual galleries, virtual museums, entertainment choices, tourist guides, TV guides, news digests, travel/hospitality option guides, virtual trade fairs and photo libraries.

**[0021]** According to a fifth aspect of the invention there is provided a browser for

5 retrieving pages of material content over a computer network, comprising means for selecting material content for display according to a predetermined algorithm, means for cross-referencing the position of each display window to a storage location of selected material content based on at least one predetermined condition, means for allocating at least part of the three-dimensional virtual space to display windows whose content is not chosen or  
10 determined by the viewer, and means for retrieving and rendering selected material content within its cross-referenced display window according to a predetermined algorithm.

**[0022]** According to a sixth aspect of the invention there is provided a business method comprising offering to download a browser (according to the fifth aspect) to a plurality of potential viewers and offering the display windows in the virtual space for rent to potential

15 rights owners in the form of business and commercial enterprises.

**[0023]** The present invention has advantages because it does not rely upon language and logic in browsing and navigating large volumes of content. Instead of relying upon language and logic, the invention makes it possible to indicate the relevance of content to a viewer by applying a rule of spatial proximity. Specifically, if content A is relevant to the viewer, and  
20 content B is similarly relevant, then A and B can be positioned near to one another, so that the viewer of content A is likely also to see content B with a minimum of navigation.

**[0024]** In order to apply the rule of spatial proximity to material content in displays, the present invention may utilize and uniquely combine three methods:



[0025] (1) The creation of a three-dimensional virtual space containing many display windows in fixed, specified positions,

[0026] (2) The realistic topographical navigation of this world by viewers, which prevents them jumping instantly from one display window to any other, but instead forces  
5 them to travel smoothly along surface channels that expose the viewer to other display windows along the way, and

[0027] (3) The operation of a self-organising allocation process in which content providers compete for the most beneficial display window positions for their content.

[0028] Corresponding to these three methods are three forms of prior art which make  
10 clear the novelty of the present invention:

[0029] (1) The creation of a virtual three-dimensional world of display in fixed, specified positions.

[0030] A browser that also configures display windows in three dimensions is described in International Patent Application Publication Number WO 01/82295. This describes a  
15 browser that arranges HTML pages on the back, top, bottom, left and right inside faces of a cube, with the viewer positioned just inside the nearest (sixth) face. Each of the five navigable inside faces can open into a further cube. The aim is to enable the viewer simultaneously to see several pages selected by the viewer. This could be especially useful where the content on the five pages is being compared or contrasted.

20 [0031] The present invention differs from this disclosure in several respects: in particular because the display windows in the present invention have fixed, specified positions in the space rather than being subject to manipulation by the viewer, and the content on display is predetermined by cross-references rather than by the viewer.

[0032] (2) The realistic topographical navigation forcing the viewer to travel smoothly along the surface and thus be exposed to display windows on the way.

[0033] Another method for searching and presenting information in a geography-based configuration which also provides realistic navigation is described in U.S. Patent Application

5 Publication Number US 2002/0059207 A1. This method converts multiple aerial photos of an actual city into a three-dimensional stereoscopic aerial view, and allows the viewer to move across this view, simulating a 'sight-seeing flight', and to request information pertaining to his or her location. This is done by linking the latitude and longitude of the viewer's position with 'landmark databases' compiled using conventional Internet searches  
10 based on keywords or other verbal expressions. Multiple viewers can interact and be tracked.

[0034] The present invention differs from this disclosure in several respects: the content being presented in the present invention is organized by predetermined cross references rather than by reference to their physical property locations, and material content is directly displayed in windows forming part of the landscape being viewed rather than indirectly

15 displayed as separate page data.

[0035] (3) A self-organizing allocation process in which content providers compete for the most beneficial display window positions for their content.

[0036] Another method comprising a self-organizing allocation process for the display of large volumes of material content is described in US Patent Number 6,308,202. This method  
20 invites each primary content provider on the Internet to select one or more of thousands of verbal categories to describe their content and then allows other secondary content providers, for example advertisers, to supply relevant additional information to anyone viewing the primary categorized content. By allowing both primary and secondary content providers to determine the categories they believe are most relevant to their content, the allocation of

secondary information to interested viewers is optimized. The present invention differs from this disclosure in several respects, particularly since material content in the present invention is displayed in predetermined cross-referenced display windows. In embodiments of the present invention: content providers select relative positions in a virtual space to describe  
5 their content rather than use verbal categories; the exposure of viewers to relevant secondary content is achieved by virtue of the required realistic method of navigation, rather than it being imposed as a separate unrequested display of content; and due to the competitive nature of the self-organising process, the 'description' (i.e. the position in the virtual space) assigned to any particular material content reflects not just its meaning but also the value  
10 ascribed to that content by its provider.

**[0037]** The present invention benefits both content providers and content viewers:

**[0038]** Content providers using embodiments of the invention have control over where and how their content is seen in the context of all content, rather than granting that control to third-party content categorizers or the rule-makers of search engine software. Content  
15 providers using embodiments of the invention also need not rely on verbal descriptions (e.g. domain names, meta-text, directory entries, or descriptive advertisements) to attract interested viewers, but instead can attract relevant viewers to their content by means of its contextual position and the quality of its visual treatment. Because the self-organizing is competitive, the prominence of displayed content is commensurate with the importance of  
20 the communication to the content provider.

**[0039]** Viewers using embodiments of the invention can rely upon the naturalistic, non-verbal experience of perceiving the relatedness of two entities by their spatial proximity, rather than relying upon terms or names they happen to recall, or entering topics into search engines in accordance with Boolean logic. Viewers can also more rapidly decide the

relevance of content by relying on quick visual impressions rather than reading lists of arbitrary text excerpts. Lastly, viewers using embodiments of the invention can experience the serendipity of discovering new, hitherto-unknown content, or content that its provider considers to be of interest to them, rather than being limited to content that the viewer has  
5 had to search for and therefore must already know about.

[0040] The present invention enables the designation and fixing of the association of material content with other material content in a three-dimensional space containing display windows that are each rendered in three-dimensional perspective. In one embodiment of the present invention, the configuration of these display windows, each containing material  
10 content, is analogous to shop windows on a city street.

[0041] To populate this system with content, content providers may be invited to specify their material content to appear in a particular window which by virtual spatial proximity associates their material content with what they consider to be related material content in surrounding and nearby display windows. In this way, associated content, presented in  
15 display windows, will self-organize into virtual neighborhoods of related content that the user can browse as one would the shop windows along streets of a city. Having located a display window with content of interest to the user, the user may without verbal or logical discernment easily find other content in nearby windows that its providers have decided would also be of interest to the user.

20 [0042] In FIG. 1 a display 1, which may be a screen of a computer, is shown, on which is depicted an image of a virtual street 2 seen in three-dimensional perspective from the middle of the street 2. Buildings 3 are located on each side of the street 2, and each has one or more virtual display windows 4 facing the street 2. The buildings and the street decrease in size, appearing to recede, as they get further from the nominal position of the viewer. The angle of

recession is chosen so that the perspective appears natural but so that content displayed in the display windows on the sides of the buildings is clear. The relative width  $w$  and height  $h$  of each display window 4 is chosen to match the content to be displayed, but in the embodiment using Internet pages is chosen to match that of the normal visible HTML page area in a traditional Internet browser, i.e., the standard screen size minus the space used by scrollbars and tool bars. This gives the viewer the impression that he is standing in a street having shops with shop windows on each side. Each virtual display window 4 shows a page of content retrieved from an Internet HTML page. These may be the home pages of commercial concerns or pages specially generated for display in this format.

[0043] The actual number of visible display windows will be chosen so that the overall view looks realistic and so that a reasonable number of the windows are clearly visible. The number can be variable in dependence upon the performance of the computer or adjustable by the viewer to enhance performance or to enhance the detail of rendering of content in the windows. For example, it may be appropriate to display two blocks of the street at a time and three windows on each side in each block but to replace the more distant windows with a low-resolution rendering or even a small icon.

[0044] The viewer's viewpoint can be moved up or down the street 2 and as it is moved, the display changes to bring other windows 4 into view and to change the relative sizes of the displayed buildings 3. The changes must be accomplished realistically and smoothly. The viewer can also turn left or right to face a particular window to inspect more carefully the content displayed there. If the content comprises Internet HTML pages then at that point the HTML page displayed in that window can be opened by the viewer to fill a separate Internet browser of more traditional two-dimensional appearance. Optionally the viewer can then interact with the chosen HTML page in the traditional manner, for example by using mouse

clicks on a part of it to access another page of information or to make a choice such as initiating a purchase from a shopping system represented on the page.

[0045] The street 2 is part of a larger virtual space such as an urban landscape in the form of a town or city set out in a grid-like city block layout although the layout of the landscape need not necessarily be in the form of a uniform perpendicular grid: "curved roads" and "traffic circles" may be incorporated and narrow "paths" may lead off from wider "streets". "Hilly" surfaces and "ravines" or other geographic representations may be included. The virtual space may be limited or infinite or limited in some directions and may be on more than one plane. The display windows will typically have straight edges as shown in FIG. 1, but may be made more eye-catching with decorated frames.

[0046] The viewer can navigate through the landscape by making appropriate key strokes on the keyboard, by mouse movements or by using a joystick, track pad, trackball, touch screen, remote control or virtual reality gloves or a steering wheel, in manners known to persons skilled in the art. Several navigation speeds are envisaged which would generally be under the control of the viewer. For example the viewer may "move" at walking speed through the "streets" or may choose to move at the equivalent speed of a taxi, within the same plane as the display windows. The viewer may also opt to move at an even higher speed in a different plane to the display windows, for example in a manner analogous to a subway system or a helicopter. However it is intended that limits would be applied to the viewer's "movement" through the landscape to avoid the possibility of the viewer instantly jumping to a specified display window location in the landscape because such a movement would undermine the organizational principle that enables the viewer to find relevant content: namely, content providers locating their content in virtual spatial proximity to associated content.

[0047] Each display window 4 may be sold or rented to a commercial concern or other organization and has a fixed position in the landscape, in a similar manner to the fixed addresses of shops or businesses in a real town or city. In this way the viewer becomes familiar with the positions of his or her favored windows and can easily search and select relevant "neighborhoods" of material content.

[0048] The display is organized by a controlling browser program operating locally, e.g. on the viewer's computer terminal. The browser program controls the display of the virtual landscape, navigation of the viewer's position through the landscape, and the retrieval, preparation and rendering of content displayed in each window. In an internal or external cross-referencing file, the URL of the Internet HTML page of each relevant commercial concern owning or renting a display window is associated in the program with the specific display window the concern has reserved. Periodically, bitmap screenshots of a set of HTML pages relevant to the windows in the local vicinity of the viewer in the landscape (e.g. those associated with all of the display windows in the blocks and streets adjacent to or around the corner from the viewer) are cached in local memory. In one implementation, this uses an adapted HTML page-rendering engine which can import live HTML pages in a way in which their contents are reproduced dynamically. Thus a set of live HTML pages is continuously saved in memory at the viewer' terminal. The number of HTML pages thus saved will depend upon the available memory and the processing power of the terminal as well as the number of windows displayed on the screen at any one time, but might typically be 9.

[0049] When a window first becomes visible in the viewer's screen, the corresponding cached HTML page is copied by the program from the internal memory and rendered in the window. The page is not rendered dynamically until the viewer turns toward it (and "clicks" on it or remains in that position for a set period of time), at which stage the dynamically

cached page may be displayed in a two dimensional, conventional-style browser display box. Totally live dynamic rendering of all visible HTML pages in-situ on a street would be possible with sufficient processing power.

[0050] As the viewer "moves" along the street, distant windows come into view and  
5 close-by ones pass out of sight "behind" the viewer. Thus the program carefully selects the set of HTML pages to cache and store in memory to ensure a smooth and fast appearance of rendered display windows as the viewer "moves", by ensuring that HTML pages corresponding to approaching windows are downloaded into memory in time. A certain amount of predictive programming must be built-in to anticipate the next likely "movements"  
10 of the viewer, for example on the basis of previous navigation patterns.

[0051] It is envisaged that facilities will be provided on an administration Internet site to allow the registration of the rights of content providers to own or rent particular display windows, to manage transactions (e.g. taxes and fees), and to allow a display window owner or tenant to upload directly their network address or storage location and maintain their  
15 display window. The rights holder may test the appearance of their display window and view statistics or contour maps indicating the number and frequency of visits to their window and/or simulations of corresponding virtual "property values".

[0052] There may be a number of different neighborhoods or districts in the virtual city, each with its own distinctive layout and look and feel, just as in a real city. For example,  
20 there may be an area in which HTML pages of interest to young people predominate, or an area which specializes in public sector content. In one embodiment, a particular area of the "city" is designated as the viewer's "hometown" area and is populated, for example, with the viewer's own favorites or bookmarked HTML pages, or with pages found from a conventional search.



[0053] Different sections of the virtual city could be designated "gated" areas which would be accessible only to users with a special subscriber pass: given either by virtue of payment made by the viewer in advance or for example on condition that the viewer has proven that they have a sufficient credit rating for financial transactions within the "gated" area or are a member of a club.

[0054] The layout of the "city" is detailed in a standard format XML file in the form of plot data, which in the example given is for a three window by three window city block grid layout, although other layouts are possible. The XML file may be contained in the control program loaded on the viewer's computer (the client) or may be retrievable from a remote server via a standard HTTP connection in which case there will be security to protect the integrity of the file.

[0055] Any of the pages may incorporate sounds but it is most practical to suppress sounds from pages other than those closest to the viewer. For example sound on the pages in the windows directly to the left and the right of the viewer's nominal position could each be set at a volume of 50% in the left and the right stereo channels respectively. If a viewer turns to face a page then that page plays at 100% volume. When a page is more than half way out of view the volume is lowered to 25%, and the volume of the next page is increased to 25%.

[0056] As already mentioned, navigation may be performed by keyboard strokes, mouse movements or a joystick. Traditionally the arrow keys on a keyboard are used for movement e.g. in one implementation when the "up" key is depressed the viewpoint moves forward at a predetermined pace, and releasing the "up" key stops the viewpoint at the next full window, i.e. at the point when the nearest vertical edges of the windows abut the left and right vertical edges of the display area. Pressing the "down" key moves the viewer back (while facing forward) and the "left" key makes the viewer turn to face the window to the left. Likewise the

"right" key is used for a right turn. At intersections of "streets" the "right" key turns the user right onto the perpendicular "street" and the "left" key turns the user left onto that "street".

[0057] More advanced forms of navigation can be incorporated, for example using a variety of keys, mouse-movement controls and right-click shortcuts and these are well

5 known, particularly in the field of video game programming and usage.

[0058] In one embodiment there is an experience simulating transport by underground

train built into the virtual city. Several display windows throughout the virtual city are

rendered to appear as underground train stations and the viewer can "enter" a station by

turning to face the relevant display window, using an appropriate navigation technique. A

10 diagrammatic map of all "underground train stations" is then displayed to the viewer "in" the station and he can then select a destination station by "clicking" on the appropriate part of the map to travel to a different part of the "city". A typical long distance "journey" might take 10

to 15 seconds and during this simulated journey the control program activates the display to the viewer of a series of advertisements which would typically be paid for by the owners of

15 the display windows near the destination station. This would be analogous to advertising

hoardings at real underground train stations and on real underground trains. At the

destination station in a different part of the virtual town, the viewer would "exit" the station

through another window rendered as a train station and emerge into a street rendered with the

HTML pages chosen by owners of display windows in that part of the "city".

20 [0059] The virtual city is typically entered only via designated gateways or portals to facilitate the viewer's familiarity with and navigation through the landscape. There is a single major "default" gateway, and a series of secondary gateways which can be selected from a map or menu or randomly offered to a viewer. The underground train stations would

comprise some of the secondary gateways. Gateways could be depicted in striking or memorable designs to aid navigation.

[0060] The selection of which gateway is used to enter the virtual city can be made by a viewer each time the program is launched but if no selection is made then the entry gateway  
5 will default to the main gateway.

[0061] A bird's-eye view topological map of the whole virtual city or the neighborhood or district in which the viewer is located at any one time is displayed, either adjacent to or behind the main viewing window. The path taken by the viewer may be highlighted on this map, either for the current session alone or for the current and at least one previous session.  
10 A zoom option would also be provided, leading to the display of larger, more detailed maps. Such a map may have certain "landmark" display windows marked, these possibly being determined by the owners having paid a fee to appear on the large scale maps. When navigating the main window in the usual way, the viewer may also be allowed to rise up above the virtual space to get an overview of his current location and environs in the virtual  
15 city.

[0062] Locations visited by a viewer could be "bookmarked" or "searched for" in the traditional manner. However, the viewer is unable to jump directly to a bookmarked or search result location but must instead travel along the streets to reach it, in one embodiment guided by the most efficient route being highlighted on the map or automatically led there  
20 through the streets. In this way the viewer will find his or her way around the virtual landscape and will learn the positions of particular Internet sites. In addition, this inability to jump means that the viewer must pass many display windows and the owners or tenants of those windows will have the advantage of more viewers seeing their content.

[0063] An avatar may represent the viewer and/or a shopping companion; for example an amusing pet or an attractive imaginary friend may be depicted on the screen. Such a companion could move just in front of the notional position of the viewer and might point out new window displays, changes, promotions, sales or windows which are considered likely to interest the viewer on the basis of past navigational behavior. Several viewers can "window-shop" together if they are logged on simultaneously. In this embodiment there is a system for assigning navigation control to one of the group. A means of communicating between the viewers, such as a text or voice chat line for conversation, or an on-screen messaging facility, may also be incorporated and the technology for such features is well known.

[0064] Viewers could also be given a visual representation of the number of other viewers in their current vicinity: for example a translucent silhouette of one person representing one thousand, or one million, other viewers. This would serve to indicate the relative popularity of neighborhoods, streets and windows and would also assist window owners or tenants to determine the effect of a change in their display or to assess the advantage of paying more "rent" or a higher "purchase price" for a display window in a busier, more popular part of the city.

[0065] The virtual buildings could have several stories, allowing different levels of windows, analogous to different stories of a shopping mall in real life. To the elevations of these virtual buildings where a display is not practicable could be affixed advertisements or virtual signs relating to the display windows immediately below them, providing a means of attracting viewers to navigate their way towards the advertiser's display window.

[0066] Streets and neighborhoods may be assigned names to assist in navigation for the viewer and to facilitate the sale or rental of prime locations. Landmarks may also be incorporated to assist the viewer in navigation. For example statues, architecturally

interesting buildings such as distinctively decorated or designed buildings, fountains and parks may be used to identify specific areas of the landscape.

[0067] Adjacent windows could be merged to create larger windows and several different virtual cities could be created and linked by a rapid transport system in a similar way to the  
5 underground railway described above.

[0068] In a more advanced embodiment viewers will pass "through" the windows and the screen will then display a virtual rendering of the "inside" of an associated establishment. Thus, for example, the display window of a supermarket can be a gateway into the virtual supermarket itself and on "entering" the window the viewer would see the virtual "streets"  
10 become virtual aisles of the supermarket. Instead of displaying HTML pages of internet sites in the windows lining the aisles, HTML pages of sets of product images are displayed and a "click" on an individual product initiates a dialog box to display product details as supplied by the retailer: for example, ingredients or other details or the sizes, prices or colors available. A transparent interface with the retailer's own existing shopping cart may be  
15 provided in the control program.

[0069] The virtual town may be replaced by other virtual three-dimensional spaces in addition to the above example of a virtual department store, supermarket or retail catalogue establishment. A virtual shopping mall would be populated with display windows representing a variety of shop fronts or a virtual museum with exhibition cases or exhibits.  
20 Other applications are envisaged such as virtual tours of representations of actual cities, virtual trade fairs, virtual photo libraries, entertainment choices (e.g. videogame selection), TV program selection, or business or academic libraries. It would also be possible to use this method to access technical data or medical records.

**[0070]** Viewers are requested to register their details and their navigation behavior could be collected for sale to display window owners or tenants.

**[0071]** Display window owners or tenants can utilize the top portion of the window for a display sign or banner of their name label or brand for the convenience of the viewers.

5 **[0072]** Many further advertising "signs" and "hoardings" could be incorporated such as to resemble hanging signs and sandwich signs outside a shop window, as well as display advertisements on the floor of the street outside a window or directing viewers to a particular window.

**[0073]** From a technical point of view, the browser software preferably comprises two  
10 sections. A first section, running at high priority, controls the display of the virtual three-dimensional environment (e.g., the virtual city) and the navigation of the viewer around that environment. A second section, running at lower priority, updates the content for display windows.

**[0074]** Steps taken by one embodiment of such a browser will now be described with  
15 reference to the flow diagram of FIG. 2 for operation of the software when installed on a network with the viewer using a client computer terminal connected via HTTP to a remote server computer.

**[0075]** In step A, the browser is first initiated and may run several brief benchmarking tests to determine the optimal settings that will ensure a smooth and responsive display. This  
20 benchmarking is determined by assessing the resources available, i.e. the computing speed, graphics card, and memory capabilities of the client computer.

**[0076]** In step B, the browser then retrieves the layout of the virtual space or world to be displayed (e.g. the virtual city) from the remote server computer or a file saved locally.

[0077] In step C, the retrieved layout is used by the software to map the virtual city for internal use by the viewer's computer (the client) and the browser generates a simulated three-dimensional environment depicting display windows closest to the nominal position of the viewer, for example at the default gateway. The perspective is adjusted to ensure that items closer to the nominal position of the viewer are larger. Each display window 4 has a relative width and height to match (or have similar proportions to) that of the visible HTML page area in a traditional Internet browser. This would typically be the standard screen size minus the space used by scroll bars and toolbars. The size of the display windows, resolution of the graphical textures in the display windows and number of rendering threads depends upon the benchmark conditions established in the initialization process. For illustration purposes, blocks of three display windows length and width are considered as shown in FIG. 1, but any configuration would be possible. The browser then assigns addresses, typically URL addresses for HTML pages, to each window according to the retrieved layout.

[0078] In step D, cached HTML pages stored as textures in the client computer memory are used to populate the display windows in memory.

[0079] In. step E, the browser displays the three-dimensional environment on the display.

[0080] In step F, the viewer can move around in the area of the street or corridor 2 between the display windows 4 and the viewer can interact with individual display windows 4. The browser also enables the viewer to interact with an underground railway station and in that case displays a map of available underground railway destinations from which the viewer can make a selection.

[0081] In step G, the browser has several threads running simultaneously, each processing material content and updating the texture used for the respective display windows. These threads comprise the following procedures:

[0082] - an algorithm running in a control thread determines which display windows require updating based on a number of factors including the locality of the user and the age of displayed content,

[0083] - the browser may initiate a connection to download the source data,

5 [0084] - source data is used to generate an invisible window,

[0085] - the contents of the invisible window are transferred into a texture,

[0086] - the textures are periodically cached to a local storage medium to permit a rapid repopulation of the environment when the browser is next run,

[0087] - display windows closest to the viewer which contain moving images or sound  
10 may be kept active so that changes are continually reflected on the display window in real time.

[0088] Log files may be used for recording the frequency with which viewers pass-by, draw close to, or interact with any display window, and thus data can potentially be provided in summary to commercial owners and tenants either free or for consideration. Such data can  
15 be displayed as a contour map indicating traffic densities across the virtual space.

[0089] The technical approach described here involves the textures used for the display windows being rendered by the client program. In an alternative technical approach, a centralized cluster of servers could create the textures, and these could be downloaded by the client program.

20 [0090] It will be seen that the display and navigation methods of the present invention can be used in business methods to raise revenues.

[0091] For example, the virtual space may be used in an analogous way to any property space and new properties can be sold or leased, ground rents and service charges imposed, property tax applied to transfers of window rights, an administration charge made for sales,



and procedures adapted to re-possess voided leases. In addition, advertising space, markings and signage can be leased, virtual moving advertising carriers included (e.g. vans or floating items), avatar shopping guides provided, and coupons could be distributed to viewers passing a particular window. Advertising agencies can act as virtual property agents for clients and  
5 virtual outdoor media owners can act as display window aggregators. Multiple interlinked three-dimensional “worlds,” each containing one or more “cities,” can be represented, and technology companies could each host separate such “worlds.”

[0092] In addition, road tolls, gateway tolls, admission fees and transport charges could be built into any model.

10 [0093] By analogy with e-commerce business methods, a sales tax could be imposed on viewers transacting with content providers. An auction system could be used to enable display window rights owners to buy or sell their rights to others. The presentation, display and navigation method has many possible applications. Apart from the HTML browsing and virtual shopping embodiments described in detail above, virtual entertainment guides, tourist  
15 guides, trade fairs and travel/hospitality guides could be created. The method also finds application in displaying the contents of libraries, photo libraries, scientific data, and medical records and it could play a role in virtual government.

[0094] FIG. 3 and FIG. 4 show alternative views of the three-dimensional space. For example in FIG. 3 the viewer is at a “corner” of a “street” with a “side street” running off to  
20 the left. In FIG. 4 the viewer is facing a display window and could potentially interact with the window in the manner of a conventional two-dimensional browser.